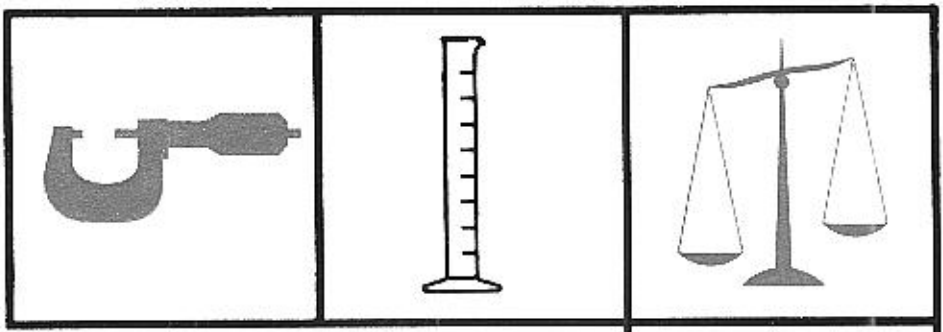
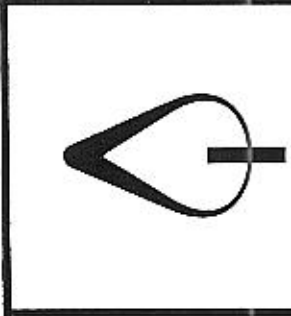
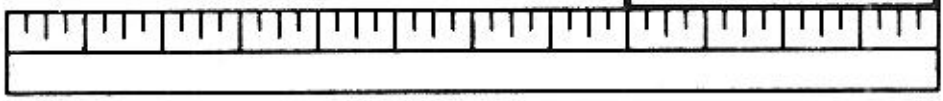


MEASURE for MEASURE

Richard A. Young
Thomas J. Glover





Preface

No book of this magnitude is put together by one or two people, and *Measure For Measure* is no exception. Many people have been involved in the conception and creation of this volume.

Many thanks to my friend and co-author, Thomas, for the idea for *Measure For Measure* and for the opportunity to compile and compute the data presented in it. Without his vision, support, and expertise in desktop publishing and database manipulation there would be no *Measure For Measure*. My deepest thanks to you, my friend.

Many talented people helped gather and compile the information on which *Measure For Measure* is based. My sincere thanks to Trisha Glover, Donna Baumgarten, Amy Full, Liz Young, Stephanie Young, Carrie Glover, and Chris Young for their support and hours of dedicated help.

A very special thanks to my beautiful wife, Millie, for the use of her artistic talents in designing the cover for *Measure For Measure* and for her love and support during our twenty-nine years of mutual respect and love. I love you my lady!

Richard

Producing a book like *Measure for Measure* has got to be asking for trouble!! The shear magnitude of this project would have been enough to scare most people out of their wits and if you couple that with the frustration of resolving why 25 different sources can't agree on a simple little conversion like Cambodian chongs to Lebanese chinbuls . . . well, you'll begin to understand what is special about my co-author and friend Richard Young. Many thanks to Millie Young for the beautiful cover art work - how does it feel to have become a graphics guru?

Special thanks are due to my family and friends for their understanding and acceptance of the sacrifices that we all must make in order to publish a book. Mom and Dad, Pat, Mary, Trish, and Carrie, without your love and support over the years, none of this would have been possible. To my new and very special children, Eric, Dena and David, welcome to my world. You have all helped to make my life complete and I love you all very much.

Thomas

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Blue Willow Books

Measure for Measure

Richard A. Young and Thomas J. Glover, 1996
ISBN 1-889796-00-X, 864 pages, soft cover, 4"x 6"

Seldovia, Alaska:
An Historical Portrait of Zaliv Seldevoe

Susan Woodward Springer, 1997
ISBN 1-889796-03-4, 240 pages, softcover, 8-1/2" x 11"

1 The International System of Units

Introduction

In the United States, the International System of Units is known simply as the "Metric System" or, more appropriately, the Modernized Metric System. The name is translated from the French *Le Système International d'Unités* and is abbreviated **SI** in all languages. **SI** was formally adopted in 1960. **SI** is a coherent system of units which, in thirty-six years, has grown to become an almost universally accepted system of units in engineering, science, trade, and commerce.

Brief History of SI

The International System of Units has evolved out of a unit of length (the **meter**) and a unit of mass (the **kilogram**). These units were created by the Paris Academy of Sciences and adopted by the National Assembly of France in 1795. On May 20, 1875, an international treaty known as the Treaty of the Meter or the Meter Convention (*Convention du Mètre*) was signed by representatives from 17 countries, including the United States.

The Treaty of the Meter established three organizations to conduct activities relating to a uniform system of units. The General Conference on Weights and Measures (CGPM, *Conférence Générale des Poids et Mesures*), the International Committee of Weights and Measures (CIPM, *Comité International des Poids et Mesures*), and the International Bureau of Weights and Measures (BIPM, *Bureau International des Poids et Mesures*) are the organizations that have ultimate control over The International System of Units. The National Institute of Standards and Tech-

nology (NIST) of the U.S. Department of Commerce is the United States representative to all three of these international organizations.

In 1960, the Eleventh General Conference on Weight and Measures adopted The International System of Units. This system is based on the **meter, kilogram, second, ampere, kelvin,** and **candela**. In 1971, the Fourteenth General Conference on Weights and Measures added the **mole** as the **SI** unit for the amount of substance.

Brief History of SI in the United States

The Congress of the United States legalized the use of a metric system throughout the United States in 1866. On April 5, 1893, the Mendenhall Order, named for T.C. Mendenhall, U.S. Superintendent of Standard Weights, established metric units as the ultimate base of all U.S. Customary Units. Thus, the pound was defined in terms of the kilogram and the yard was defined in terms of the meter. The Metric Conversion Act of 1975 designated the "metric system of measurement as the preferred system of weights and measures for United States trade and commerce," and furthermore, the "metric system of measurement" was defined as The International System of Units.

Since 1975, additional federal laws, regulations, and executive orders have extolled the voluntary use of **SI** in the United States. Unfortunately (or fortunately, depending on your point of view), **SI** has never been mandated by law as the official system of units in the United States. Although many professional societies and associations in the United States have officially adopted **SI** for use in their journals, conference proceedings, magazines, and books, the English or Imperial units remain firmly entrenched in every day American life.

SI Basics

SI has seven *base* units (**meter, kilogram, second, ampere, kelvin, mole,** and **candela**) and two *supplementary* units (**radian** and **steradian**). The seven base units are fundamental, independent quantities (length, mass, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity) which have been defined and measured with a high degree of certainty. A definition and brief history of each base unit is included later in this chapter in the section entitled **SI Base Units** (page 22.).

SI is a coherent system of units, which means that all necessary units can be formed as products and quotients of the base and supplementary units. All units formed in this manner are called derived units. Nineteen of these derived units have been given special names (becquerel, coulomb, degree Celsius, farad, gray, henry, hertz, joule, lumen, lux, newton, ohm, pascal, siemens, sievert, tesla, volt, watt, and weber).

Table 1, on page 10, presents the names of quantities approved for use in **SI**, the name of the **SI** unit for each quantity, the unit symbol, and the expression for each unit in terms of either base or derived units. Figure 1 on page 21 illustrates the relationships between the base and supplementary units and the nineteen derived units with special names.

SI is a decimal system meaning that subdivisions of units are based on multiples of 10. Multiples or subdivisions are noted in **SI** by prefix names which express the power of 10 (exponent) to be applied to a given multiple or subdivision. Table 2, on page 20, presents the multiplication factors, exponents, prefix names, prefix symbols, and pronunciation for all prefixes in **SI**.